Meeting Date: 24 October 2019

Review of October 2019 New Zealand generation balance report

Security and Reliability Council

This paper comments on the latest New Zealand Generation Balance report issued by the system operator, which covers the period of overlapping planned outages of the HVDC and Pohokura gas production facility in March 2020.

Note: This paper has been prepared for the purpose of the Security and Reliability Council (SRC). Content should not be interpreted as representing the views or policy of the Electricity Authority.

1. Background

1.1. At its meeting on 8 August 2019, the SRC received a brief note on the overlapping planned outages of the HVDC and Pohokura gas production facility in March 2020.

1.2. The Authority Board then wrote to the SRC on 16 September 2019 seeking advice on "what level of concern is warranted and whether there are additional actions that the Authority, the System Operator and market participants could be taking to mitigate risk."

2. New Zealand Generation Balance report

2.1 Transpower, in its role as system operator, is responsible for monitoring security of supply risks. As part of this process, Transpower publishes a monthly "New Zealand Generation Balance" (NZGB) report for the coming six months.

2.2 The NZGB report quantifies the security risk by calculating the MW capacity difference between daily peak demand and generation for a range of scenarios. The risk for each scenario is tested by accounting for planned outages, and then assuming certain other large transmission and generation assets are not available.

2.3 The default tests shown in the NZGB report are "N-1" and "N-1-G". N-1 is a test in which the largest asset (transmission or generation) is unavailable. N-1-G is a test in which the two largest assets are unavailable.

2.4 If either of these tests shows a negative value, it indicates normal security levels cannot be maintained. This does not indicate that there will be interruption to supply, but rather (for the N-1 test) that if a large asset is unavailable for some reason, the system will operate with a reduced level of instantaneous reserves cover. However, if large deficits were to occur, then it would require forced demand cuts.

2.5 The October 2019 NZGB report (attached as Appendix A) highlights two periods of interest:

a) an outage for the Kupe gas field in November 2019

b) various outages for the HVDC during early 2020. This period includes an outage for the Pohokura gas field from 11-24 March 2020.

2.6 We consider both periods in more detail below.

Kupe outage in November 2019

2.7 The October NZGB report shows there is one day in November that has an expected margin of less than zero (i.e. a generation shortfall) in the "base" scenario for the N-1-G test, and no days with a shortfall for the N-1 test.

2.8 The N-1-G test can be considered to be a relatively extreme case, because there is a low likelihood of two large supply assets unexpectedly not being available.

2.9 The NZGB report also considers a "reduced gas" scenario, and during the Kupe outage, Transpower considers this to be the probable scenario. As such, we consider results from the reduced gas scenario to be a better indication of risk

during this period. In this scenario, the N-1-G test results in five days in November with a shortfall, the largest of which is 190 MW.

2.10 The N-1 test is not shown for the reduced gas scenario. However, we can infer that there would be no shortfall for this test because the smallest possible asset used when performing risk tests for the North Island is 220 MW.

2.11 These results indicate a high chance of reduced supply margin in parts of November 2019 (shown by a shortfall for the N-1-G test). Shortfalls in N-1-G tests are not unusual and have occurred in many NZGB reports since their inception in 2017, despite no instances of system-wide reserve shortfall during that time.

2.12 A shortfall in the N-1 test would be of more concern. When this occurs, the system operator issues a Customer Advice Notice advising market participants of the situation.

2.13 As such, we do not consider the NZGB report for the Kupe outage in November 2019 to be a cause for concerns about security and reliability of supply.

HVDC and Pohokura outages in early 2020

2.14 Transpower has scheduled a maintenance period for the HVDC from 7th January 2020 to 9th April 2020. During this time, one or both HVDC poles will be unavailable and transfer capacity will vary from 0 MW (a complete bipole outage) to 780 MW. There will be four days with a complete bipole outage. These all fall on Saturdays.

2.15 During part of this period, supply will also be impacted by a complete outage of the Pohokura gas field (for two weeks from the 11th March 2020 to 24th March 2020). One Saturday in this period will coincide with a complete HVDC outage, and for the remainder of the time HVDC transfer capacity will be limited to between 406 MW and 500 MW.

2.16 Despite these outages, there are no forecast generation shortfalls in either the N-1-G or N-1 test for the probable reduced gas scenario. At first sight, this is a surprising outcome, given the combined reduction from HVDC capacity and Pohokura's effect on gas fired generation.

2.17 However, forecast demand is significantly below winter levels during March, and the HVDC outages have been scheduled for a long time, resulting in few planned North Island generation outages. Even before the Pohokura outage was announced, Transpower had rescheduled the bipole outages to instead occur on weekends to lower the impact. Genesis Energy rescheduled a Huntly Rankine outage until after the HVDC and Pohokura outages are completed.

2.18 Overall, the NZGB forecast is for sufficient capacity to be available in the system to deal with the planned transmission and gas supply outages, and maintain normal security even in N-1-G events. As such, we do not consider the HVDC and Pohokura outages in early 2020 to be a cause for concerns about security and reliability of supply.

3. Possible actions for the Authority, system operator or market participants

3.1 The letter from the Board seeks the SRC's advice on possible actions the Authority, the system operator or market participants could take to mitigate risk.

3.2 As noted above, the NZGB report suggests there is no major cause for concern in March 2020 based on present information. Nonetheless, there are some actions which merit consideration to confirm the risk assessment, and/or further reduce risk. Some of the actions appear relatively straightforward, and others would require further analysis to test their merit.

System operator to clarify how the 'reduced gas' scenario is calculated

3.3 The NZGB report provides limited information on the assumptions used in the two 'reduced gas' scenarios. The reduced gas supply is labelled identically for both the Kupe and Pohokura outage, despite very different quantities of gas supply being affected.

3.4 For the Kupe outage, the reduction in generation capacity varies but is up to 530 MW. For the Pohokura outage, it appears the reduced gas scenario removes around 370 MW of generation capacity. On their face, these assumptions are surprising as a complete shutdown of Pohokura will reduce gas production by about 200 TJ a day, which is enough to fuel about 1,050 MW of generation capacity.

3.5 This 'counterintuitive' result is plausible if most of Pohokura's gas reduction will fall outside the generation sector (e.g. onto Methanex). We assume this is the case based on the NZGB report. Nonetheless, **this is a critical assumption, and it would be helpful for the report to provide more information on how assumptions have been compiled** (even if some detail needs to be withheld for commercial reasons).

3.6 We understand that Transpower consults with market participants to construct the reduced gas scenario. However, the information received by Transpower could be used on an "as-given" basis, or it could be used by Transpower as one of many inputs to its assessment of system conditions. It is not immediately obvious which approach has been used to create the reduced gas scenario.

System operator to confirm how hydro generation is treated

3.7 It is not entirely clear, but the NZGB report appears to assume that hydro generators will be 'fully fuelled' – i.e. no derating is made to reflect prevailing hydro storage levels. This may be a reasonable assumption, if hydro generators have sufficient operational flexibility to attain full generation for a few hours a day, even in drought conditions.

3.8 However, the level of hydro generation is a critical assumption. It would be useful to understand whether the NZGB assumptions re hydro generation are reasonable in light of past experience. This would be particularly important if the North Island is experiencing drought conditions in March 2020, because any required derating should be factored into future NZGB reports.

System operator to provide more guidance about interpretation of shortfalls

3.9 The system operator could provide more guidance in NZGB reports for interpreting a negative margin result. At present, it shows the size of the MW shortfall under N-1 and various N-1-G scenarios. When "reduced gas" is considered to be the probable situation, it could be useful to also show results for N-1, to provide a clearer indication of the exposure to single risks.

3.10 Likewise, as noted above, it would be useful to understand whether the "reduced gas" scenario reflects the system operator's assessment, or simply reflects an "as given" compilation of participant information.

3.11 Finally, if a shortfall is indicated, the report advises participants "not to schedule further outages on these dates". There could be merit in providing further commentary about implications of different shortfall amounts.

System operator or Electricity Authority to establish reporting of trends in NZGB results

3.12 The system operator or the Electricity Authority could establish and publish regular reporting based on the history of NZGB results. Such reporting could give insight into:

a) any trends in NZGB results, such as declining margins

b) how significant any particular NZGB result is in the context of historical results

c) how results vary the closer they get to real-time (is the forecast made six months is advance usually more alarming than the forecast made one month in advance?)

d) how accurate the assumptions used were.

4. Questions for the SRC to consider

4.1 The SRC may wish to consider the following questions.

Q1. Has the system operator been able to provide clarification/confirmation of the matters raised in sections 3.2-3.4?

Q2. Does the SRC have any reason to believe the NZGB results, or the system operator's judgements, are not producing reasonable indications of the level of risk?

Q3. Are there any additional actions that the Authority, the system operator and market participants could be taking to mitigate risk?

Q4. What further information, if any, does the SRC wish to have provided to it by the secretariat?

Q5. What advice, if any, does the SRC wish to provide to the Authority?

Appendix A: October 2019 NZGB report

New Zealand Generation Balance – October 2019

Executive Summary

The generation balance for the next 6 months indicates one anticipated shortfall (N-1-G) during the month of November. This is due to potentially high forecasted loads as well as an outage on a large North Island thermal generator. Additionally, under sensitivity scenario conditions of a major, slow starting North Island generating unit not being offered, shortfalls could be encountered on several other days in October, November and December (please refer to table 2 for specific dates).

The October report assessment is based on the data available as of 26/9/19 and now includes March 2020 in the study window. It also includes additional sections outlining the analysis of the Kupe Gas Field outage scheduled between October and November 2019, and the HVDC 2020 outages scheduled between January and April 2020.

Table 1: Significant outage dates

	Outage	Start	End
Generation	HLY_4	25/09/19	01/11/19
	TCC	29/09/19	04/10/19
	TCC	13/10/19	24/10/19
	SFD_22	19/10/19	19/10/19
	WHI	22/10/19	22/10/19
	SFD_22	28/10/19	16/12/19
	SFD_21	01/11/19	12/11/19
	NAP_1	03/11/19	23/11/19
	HLY_5	15/11/19	22/11/19
	TCC	16/11/19	01/12/19
	TKU	20/11/19	20/11/19
	KAG	25/11/19	26/11/19
	SFD_22	30/11/19	30/11/19
	HLY_4	01/12/19	16/12/19
	HLY_1	01/12/19	08/12/19
	WHI	02/12/19	06/12/19
	KAG	04/12/19	15/12/19
	RPO	25/01/20	25/01/20
Transmission	THI_WKM_1	13/11/19	15/11/19
	HVDC Pole 2	07/01/20	31/01/20
	HVDC Bipole	18/01/20	18/01/20
	HVDC Electrode	19/01/20	31/01/20
	HVDC Bipole	01/02/20	01/02/20
	HVDC Pole 2	02/02/20	26/02/20
	HVDC Pole 3	27/02/20	06/03/20
	HVDC Bipole	07/03/20	07/03/20
	HVDC Pole 3	08/03/20	09/04/20
	HVDC Electrode	08/03/20	20/03/20
	HVDC Bipole	21/03/20	21/03/20
	CYD_CML_TWZ_2	17/03/20	18/03/20
	CYD Bypass	18/03/20	21/04/20

To mitigate the risk of a shortfall on dates where a tight generation balance margin is forecasted market participants should:

1. avoid scheduling additional outages which may remove or constrain generation; and
2. adjust demand and generation offers to minimise the risk of shortfall.

Figure 1 shows generation balance margins from the *long-term* studies. Figure 2 shows the generation balance margin from the *long-term* studies for the sensitivity scenario where a large North Island thermal

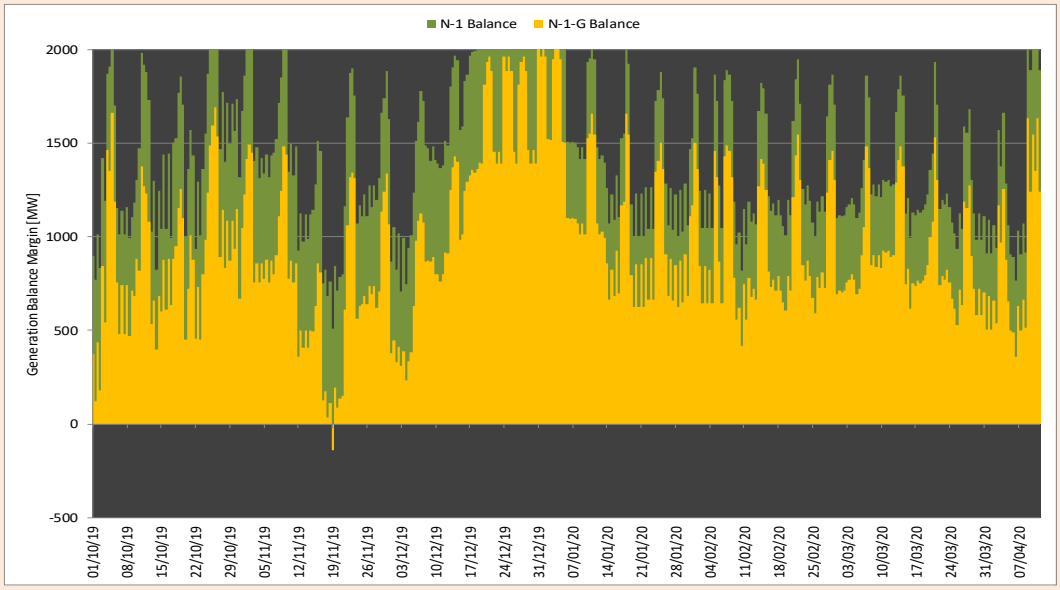

Figure 1: Generation balance study results for the period studied

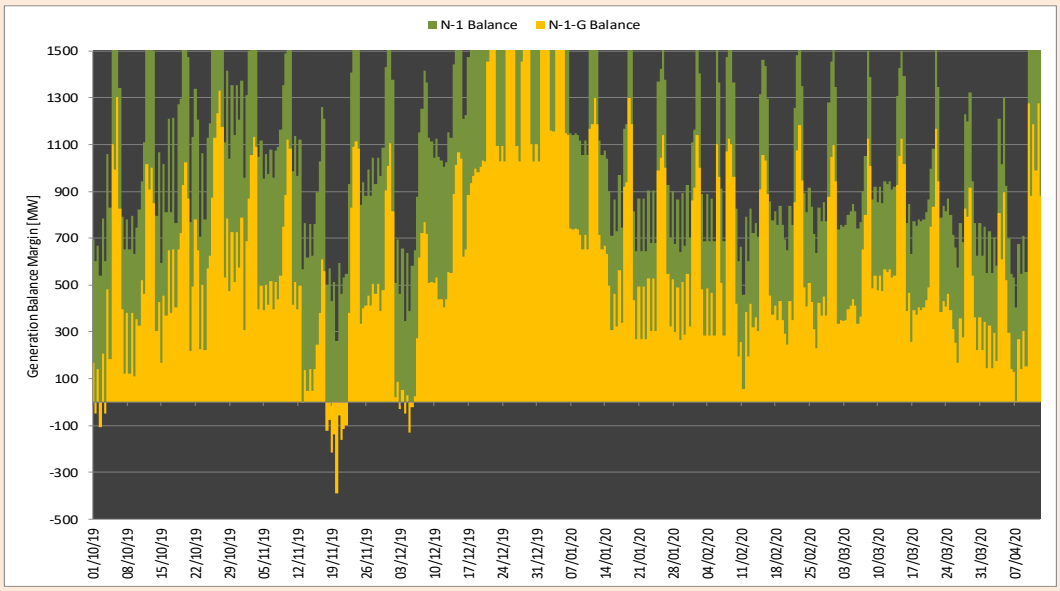

Figure 2: Generation balance sensitivity scenario study results for the period studied

Low generation balance margins for the period studied

There is a shortfall forecasted for the 20th of November 2019 due to an outage on a large NI thermal unit. Under sensitivity scenario conditions of a major, slow starting North Island generating unit not being offered, there are several further shortfalls forecasted throughout October, November and December due to potentially high loads and several generator outages.

A summary of the study results for these dates, as well as a summary of outages causing the low generation balance margins, are detailed in Table 2.

Table 2: Result of the long-term generation balance studies.

Date (Day)	Base Scenario		Worst Case Sensitivity Scenario		Outages				
	N-1 Margin	N-1-G Margin	N-1 Margin	N-1-G Margin	Generation		Transmission		HVDC
					NI	SI	NI	SI	
Tue 01/10/19	832	182	602	-48	550	250	0	100	50
Wed 02/10/19	772	122	542	-108	600	250	0	100	50
Thu 03/10/19	832	182	602	-48	500	200	50	100	0
Wed 13/11/19	926	357	566	-3	500	300	500	0	50
Mon 18/11/19	753	128	503	-122	1250	400	0	0	100
Tue 19/11/19	683	33	433	-217	1300	350	50	0	100
Wed 20/11/19	510	-140	260	-390	1500	350	0	0	150
Thu 21/11/19	714	89	464	-161	1250	400	0	0	150
Fri 22/11/19	799	149	549	-101	1200	300	50	0	100
Tue 03/12/19	823	331	463	-29	1050	350	0	100	100
Wed 04/12/19	705	310	345	-50	1050	450	0	100	100
Thu 05/12/19	748	231	388	-129	1150	450	0	0	100

To mitigate the risk of a shortfall on the dates of a low or negative generation balance forecast, market participants should:

1. avoid scheduling additional outages which may remove or constrain generation; and
2. adjust demand and generation offers to minimise any risk of shortfall.

Changes since the September 2019 report

The following changes have been made since the September report:

1. NZGB's modelling has been updated to include the impact of the Clyde Bypass.

Notable outages

Notable outages of generation and transmission equipment that impact the generation balance for the period studied are shown in Figure 3.

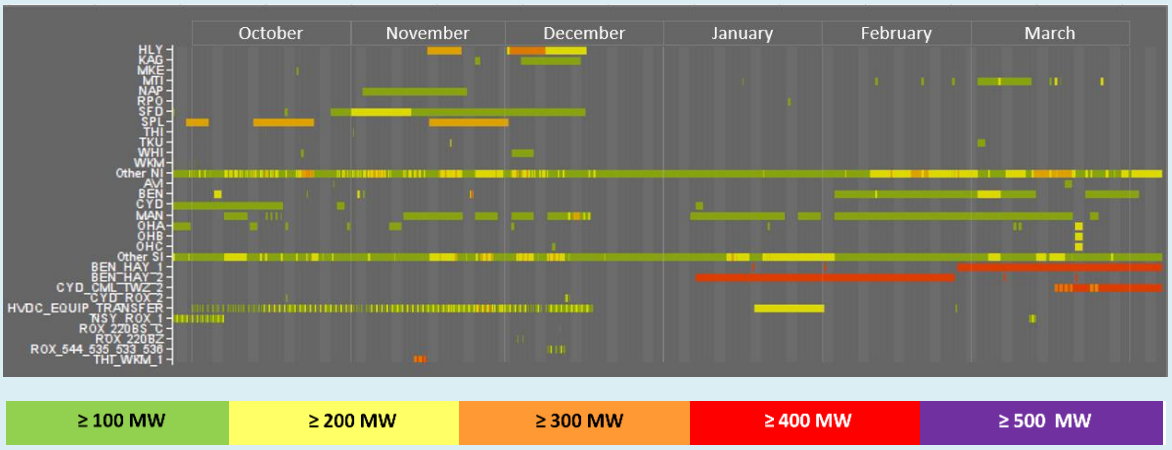

Figure 3: Significant generation and transmission equipment outages.

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Kupe Gas Field 2019 Outage

An outage on the Kupe Gas Field has been scheduled between the 30th of October and the 27th of November 2019. Analysis of these dates has been summarised below in Table 3. This analysis includes a low gas scenario which should be considered probable due to the gas outage.

There are several dates between the 13th and 22nd of November where shortfall margins will be tight or there is a risk of shortfall. We advise participants not to schedule further outages on these dates.

Table 3: Result of the generation balance studies for the Kupe Gas Field 2019 outage.

Kupe Outage Date	NI Load	NI Generation Outages	Generation Balance (N-1-G)	Generation Balance (N-1-G) reduced gas, wind = 20%	Generation Balance (N-1-G) reduced gas, wind = 0
30/10/2019	3883	258	875	353	269
31/10/2019	3883	524	935	413	329
1/11/2019	3463	384	669	147	63
2/11/2019	3132	493	1228	706	623
3/11/2019	3773	546	1451	924	840
4/11/2019	3773	549	757	230	164
5/11/2019	3773	527	754	227	161
6/11/2019	3773	546	776	249	165
7/11/2019	3773	502	757	230	147
8/11/2019	3463	502	801	279	195
9/11/2019	3132	502	1110	588	504
10/11/2019	3773	527	1442	920	836
11/11/2019	3773	545	776	254	170
12/11/2019	3773	496	758	236	170
13/11/2019	3773	427	357	-165	-249
14/11/2019	3773	427	407	-115	-198
15/11/2019	3463	1117	407	-115	-198
16/11/2019	3148	1117	495	445	361
17/11/2019	3718	1229	810	760	676
18/11/2019	3718	1325	128	78	-6
19/11/2019	3718	1497	33	-17	-101
20/11/2019	3718	1268	-140	-190	-274
21/11/2019	3718	1208	89	39	-45
22/11/2019	3246	769	149	99	15
23/11/2019	3148	614	1060	888	776
24/11/2019	3718	793	1313	1141	1029
25/11/2019	3718	716	564	392	280
26/11/2019	3718	717	641	469	357
27/11/2019	3883	258	640	468	356

HVDC 2020 Outages

HVDC outages are scheduled for 7 January to 9 April 2020. An analysis of generation balance during the HVDC bipole outages scheduled between January - March 2020 is summarised below in Table 4.

A reduced gas scenario and a combined reduced gas/no wind scenario have also been considered. The generation balance margins (N-1-G) are satisfactory during the bipole outages for all scenarios.

Table 4: Result of the generation balance studies for HVDC 2020 Bipole Outages.

Bipole Outage Date	NI Load	NI Generation Outages	Generation Balance (N-1-G)	Generation Balance (N-1-G) reduced gas, wind = 20%	Generation Balance (N-1-G) reduced gas, wind = 0
18/01/2020	3036	107	1168	928	816
1/02/2020	3079	122	1110	869	758
07/03/2020	3170	238	902	662	550
21/03/2020	3160	153	998	741	629

The single electrode outages concurrent with an HVDC monopole outage result in reduced HVDC transfer capability. Our modelling has been updated to reflect the reduced transfer limit. Our analysis shows there are no generation shortfalls during these outages for our base case scenario.

During the Pohokura gas outage scheduled for the 11th until the 24th of March 2020, a reduced gas scenario is considered more probable. Analysis of generation balance during this time is shown in Table 5.

Table 5: Result of the generation balance studies for HVDC 2020 Outages and Pohokura Gas Outage.

Pohokura Outage Date	NI Load	NI Generation Outages	Generation Balance (N-1-G)	Generation Balance (N-1-G) reduced gas, wind = 20%	Generation Balance (N-1-G) reduced gas, wind = 0
11/03/2020	3547	291	833	466	354
12/03/2020	3550	206	915	548	436
13/03/2020	3550	231	890	523	412
14/03/2020	3145	238	1288	916	804
15/03/2020	3058	238	1375	1003	891
16/03/2020	3619	305	747	375	263
17/03/2020	3619	437	615	243	132
18/03/2020	3619	318	735	363	251
19/03/2020	3619	298	754	382	270
20/03/2020	3619	259	793	421	309
21/03/2020	3160	153	998	741	629
22/03/2020	3215	153	1303	936	824
23/03/2020	3692	235	744	377	265
24/03/2020	3692	209	770	403	291

For further information on the HVDC outages is available on the Transpower website.